Litterfall in a peri-urban mangrove receiving raw domestic sewage, Mombasa, Kenya?

M.O.S. Mohamed[1,2,4,5], P. Mangion[2], S. Mwangi[4], J.G. Kairo[4], F. Dahdouh-Guebas[1, 3] & N. Koedam[1]

[1]Laboratory of General Botany and Nature Management, Mangrove Management Group, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium.
[2]Department of Analytical and Environmental Chemistry (ANCH), Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium.
[3]Département de Biologie des Organismes Université Libre de Bruxelles - ULB Campus du Solbosch, CP 169, Avenue F.D. Roosevelt 50, B-1050 Bruxelles, Belgium.
[4]Kenyan Marine and Fisheries Research Institute, P.O. Box 81651-80100, Mombasa, Kenya.
[5]Biodiversirty Research and Monitoring, Mombasa Field Research Station, Coast Conservation Area, Kenya Wildlife Service, P.O. Box 82144-80100, Mombasa, Kenya. E-mail: msaid@kws.go.ke

Abstract

The productivity of an under-valued, over-exploited and sewage polluted peri-urban mangrove through litterfall studies. The study site has been exposed to raw domestic sewage for decades, dozed every tidal cycle, the loading exponentially reducing with distance from the source. Litter from three common mangrove species, *Rhizophora mucronata*, *Avicennia marina* and *Sonneratia alba* were monitored over a period of two years. Litter fall, in both content and quantity was seasonal, with high rates occurring in the dry North Easterly Monsoon (NEM) season, January-April (ca. 5.10 ± 1.36 g DW m^{-2} day^{-1}) and lower rates in the cool and wet South Easterly Monsoon (SEM) season, June-October (ca. 2.53 ± 0.47 g DW m^{-2} day^{-1}). Productivity varied significantly between species, *R. mucronata* recording the highest annual rate of 15.34 ± 3.34 t $ha^{-1}yr^{-1}$. No significant differences in litter fall was observed between *A. marina* and *S. alba*, (11.44 ± 2.90 and 9.69 ± 5.26 t $ha^{-1}yr^{-1}$ respectively). Sewage exposure did not impact on litterfall rates for all species. However, a strong correlation exists between the leaf C:N ratio and leaf $\delta^{15}N$ signature. Higher C:N ratio for *R. mucronata* corresponding with lower leaf $\delta^{15}N$ (3.88 ± 0.64‰) signature, and lower C:N ration for *A. marina* and *S. alba* (6.48 ± 0.03‰ and 6.76 ± 0.24‰ respectively) corresponding with higher $\delta^{15}N$ signature, reflecting species specific response to sewage exposure. The forest has a more open N cycle, favouring $\delta^{15}N$ accumulation within the system. However, the level of sewage exposure did not appear to impact litterfall rates. The mean annual litter fall was estimated at 12.16 ± 2.89 t $ha^{-1}yr^{-1}$ for the whole stand. This study shows that sewage exposure does not necessarily translate into elevated productivity in mangroves, but may alter leaf total nitrogen content depending on species, possibly altering the decay of litter, affecting nutrient cycling within the system.

Keywords
peri-urban, litter fall, sewage, nutrients, $\delta^{15}N$